

MOTION

Motion involves a change in location. There are different ways of measuring motion. These can be placed into two categories:

1. **Scalar Quantity:** A scalar quantity, or **scalar**, describes the size of a measurement or the amount (number) being counted, a factor known as magnitude. A scalar quantity has **magnitude only**. It does not include direction. For example: You walk 4km/h.
2. **Vector Quantity:** A vector quantity, or **vector**, has both **magnitude and direction**. For example: You walk 4km/h [E].

Directions are designated as positive or negative when using vectors. North, east, up, and right are positive (+) and south, west, down, and left are negative (-). If a skater travelled from 9m east of a hydrant to 5m west of the hydrant, to calculate her displacement, 9m [E] becomes + 9m and 5m [W] becomes - 5m.

$$\vec{\Delta d} = \vec{d_f} - \vec{d_i}$$

$$\begin{aligned}\vec{\Delta d} &= -5\text{m} - (+9\text{m}) \\ &= -14\text{m}\end{aligned}$$

Since the negative sign (-) represents west, the skater's displacement is 14m [W].

An object in uniform motion travels equal displacements in equal time intervals. It does not change speed or direction. A **position-time graph** shows how an object's position changes over time, allowing its motion to be analyzed. These graphs have the following characteristics:

- * Time is plotted on the horizontal axis (x-axis) and position is plotted on the vertical axis (y-axis).
- * Uniform motion is shown as a straight line.
- * Real motion is not perfectly uniform. It is useful to use a **best-fit line**, a smooth curve or straight line that most closely fits the general shape outline by the points, to graph real motion.
- * Positions and times not given as data can be estimated by finding the location corresponding to a specific time and position on the best-fit line. The line can also be extended beyond the first and last points to indicate what might happen beyond the measured data.

The **slope** of a graph refers to whether a line is horizontal or goes up or down at an angle. There are three types of slope on a position-time graph - **positive, zero and negative**.